

Exponential Functions, Growth, and Decay

Warm-up

3.29.16

Lesson 25

11.2

1) What is the equation for a linear function?

2) Is this set of data linear? How can you tell?

x	0	1	2	3
y	4	7	10	13

An **exponential function** has a variable as an exponent. The parent exponential function is $f(x) = b^x$ where the base “b” is a constant and the exponent “x” is the independent variable.



The diagram shows the formula $f(x) = b^x$ with a blue arrow pointing to the base 'b' labeled 'Base' and a red arrow pointing to the exponent 'x' labeled 'Exponent'. Below the formula, it states 'where $b > 0, b \neq 1$ '.

A function of the form $f(x) = ab^x$ with $a > 0$ and $b > 1$ is an **exponential growth function**.

When $0 < b < 1$ the function is called an **exponential decay function**.

An **Asymptote** is the horizontal line that the graph's end behavior approaches.

Examples:

I do:

Is this an exponential growth or decay function?

Where is the asymptote?

$$f(x) = 10 \left(\frac{1}{2}\right)^x$$

Function	$f(x) = 10 \left(\frac{1}{2}\right)^x$
Identify b	$b = \frac{1}{2}$
Identify growth or decay	$0 < \frac{1}{2} < 1$ Decay

We Try:

Is this an exponential growth or decay function?

Where is the end behavior?

$$f(x) = 2(1.5)^x$$

Function	$f(x) = 2(1.5)^x$
Identify b	b=1.5
Identify growth ($b > 1$) or decay $0 < b < 1$	growth

You Try With your partner:

Is this an exponential growth or decay function?

Where is the end behavior?

$$f(x) = 5(.5)^x$$

Function	$f(x) = 5(.5)^x$
Identify b	
Identify growth ($b > 1$) or decay $0 < b < 1$	

You Try SOLO:

Is this an exponential growth or decay function?

Where is the end behavior?

$$f(x) = 2(-.10)^x$$

Function	$f(x) = 2(-10)^x$
Identify b	
Identify growth ($b > 1$) or decay $0 < b < 1$	

GROWTH DECAY BOX

	+a	-a
$b > 1$		
$1 > b > 0$		

Exponential Function transformations

I do:

What are the parent functions?

$$y = 2(.4)^{x+2}$$

$$y = -3(4)^{x-3} + 5$$

$$y = 3(4)^x - 3$$

$$y = -2\left(\frac{1}{4}\right)^x$$

Parent Formula $y = b^x$

We Do:

What are the parent functions?

$$y = -2(3)^{x+2}$$

$$y = -3(.5)^{x+3} + 5$$

$$y = 3(2)^{x-2}$$

$$y = -2(4)^x + 5$$

You Do Solo:

What are the parent functions?

$$1) y = 12(.4)^x$$

$$y = a(b)^{x-h} + k$$

What do you think the h does?

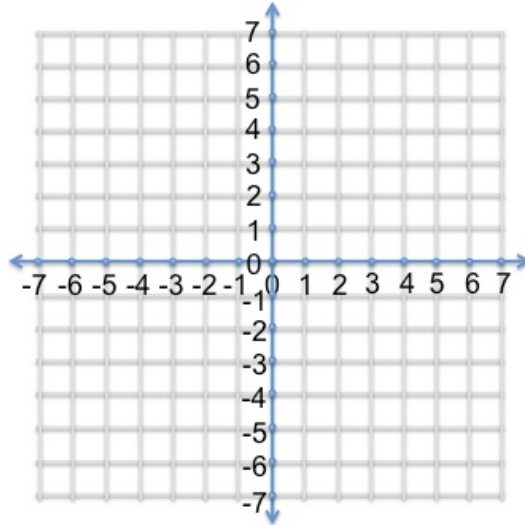
What do you think the k does?

What if a was negative?

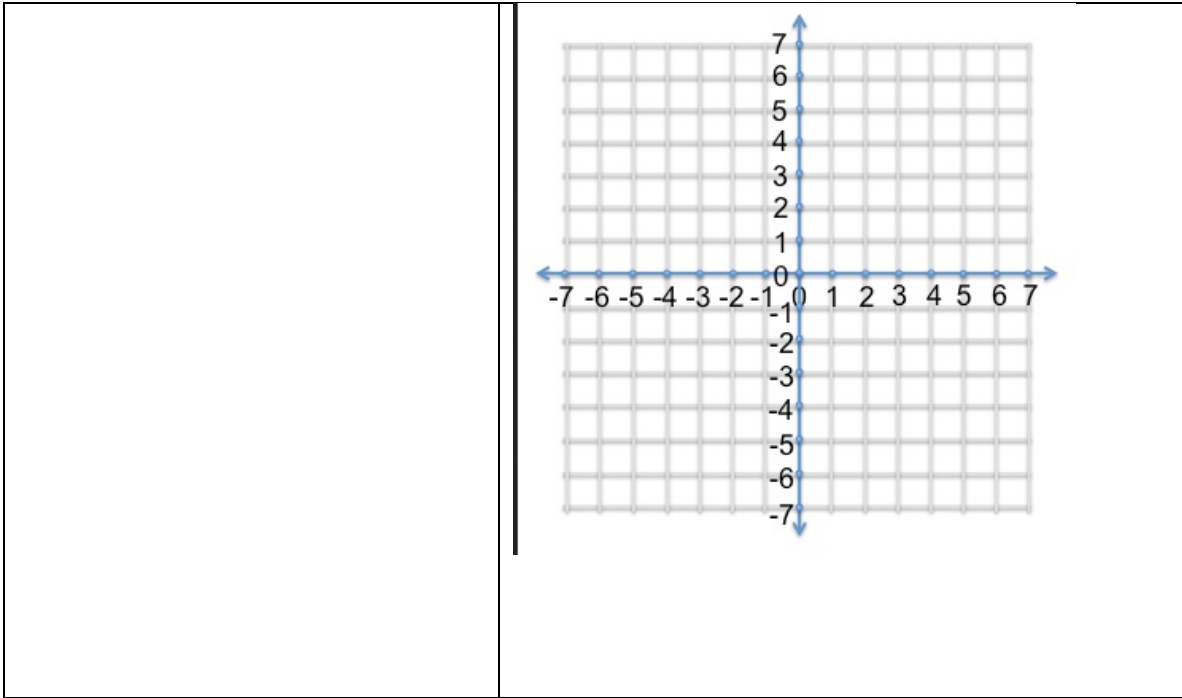
a also affects the y intercept.

$$f(x) = (3)^{x-2} + 4$$

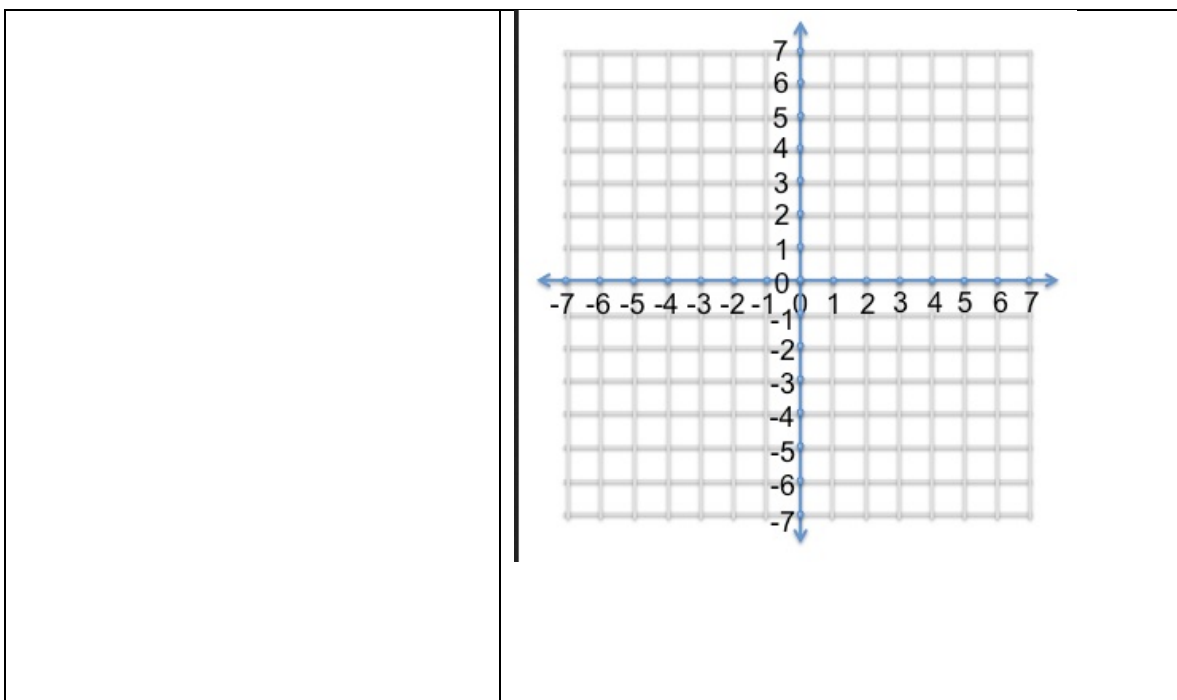
Function	$f(x) = 2(3)^{x-2} + 3$
Find the parent function	
Plot the parent function points.	$(0, \frac{1}{b})(-1, 0)(1, b)$
Apply transformations.	



Function	$f(x) = -1(2)^x + 3$
Find the parent function	
Plot the parent function points.	$(0, \frac{1}{b})(-1, 0)(1, b)$
Apply transformations.	



Function	$f(x) = (3)^{x-2} - 1$
Find the parent function	
Plot the parent function points.	$(0, \frac{1}{b})(-1, 0)(1, b)$
Apply transformations.	

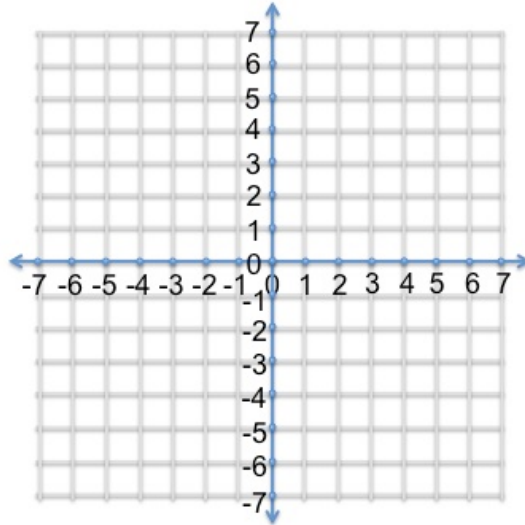


Graphing exponential inequalities.

Function	$f(x) > (3)^{x-2} - 1$
Find the parent function	
Plot the parent function points.	$(0, \frac{1}{b})(-1, 0)(1, b)$
Apply	

transformations.

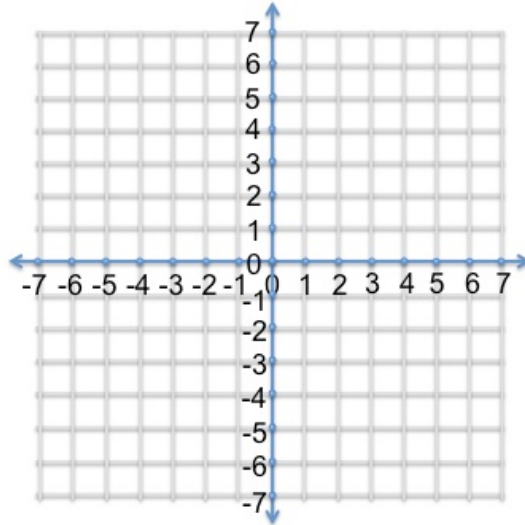
Do the (0,0) test
and shade.



Function	$f(x) \leq -(2)^{x-1} + 3$
Find the parent function	
Plot the parent function points.	$(0, \frac{1}{b})(-1, 0)(1, b)$
Apply	

transformations.

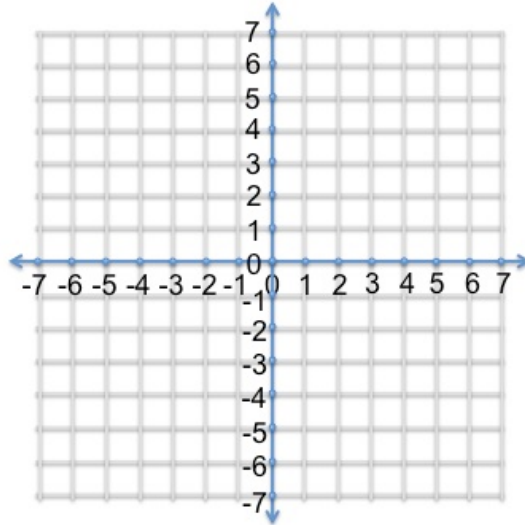
Do the (0,0) test
and shade.



Function	$f(x) \geq 3(4)^x - 2$
Find the parent function	
Plot the parent function points.	$(0, \frac{1}{b})(-1, 0)(1, b)$

Apply
transformations.

Do the (0,0) test
and shade.



Compound and continuous Interest

Compound
Quarterly , Monthly

$$A = P \left(1 + \frac{r}{n} \right)^{nt}$$

Continuously

$$A = Pe^{rt}$$

P= Principal- the starting
amount

R=*annual interest Rate*

T= Time

A= Amount after years

P= Principal- the starting amount

R=*annual interest Rate*

N=Number of interest periods in a year

T= Time

A= Amount after years

Jason recently inherited \$30,000. He has a couple of savings plans to choose from.

Plan 1

5.5% interest

Compounded Quarterly for 13 years

How much money would he earn using this plan?

Identify all the variables. Round to the nearest cent.

Plan 2

4.6% interest

Compounded Monthly for 13 years

How much money would he earn using this plan?

Identify all the variables. Round to the nearest cent.

Quarterly, Monthly

$$A = P \left(1 + \frac{r}{n} \right)^{nt}$$

P= Principal- the starting amount

R=*annual interest Rate*

N=Number of interest periods in a year

T= Time

A= Amount after years

Continuously

$$A = Pe^{rt}$$

P= Principal- the starting amount

R=*annual interest Rate*

T= Time

A= Amount after years

Jasona recently inherited \$15,000. She has a couple of savings plans to choose from.

Plan 1

5.2% interest

Compounded Quarterly for 12 years

How much money would he earn using this plan?

Identify all the variables. Round to the nearest cent.

Plan 2

4.1% interest

Compounded Monthly for 12 years

How much money would she earn using this plan?

Identify all the variables. Round to the nearest cent.

Sona recently inherited \$20,000. She has a couple of savings plans to choose from.

Plan 1

7.1% interest

Compounded Quarterly for 15 years

How much money would he earn using this plan?

Identify all the variables. Round to the nearest cent.

Plan 2

6.1% interest

Compounded Monthly for 15 years

How much money would she earn using this plan?

Identify all the variables. Round to the nearest cent.

Ona recently inherited \$12,000. She has a couple of savings plans to choose from.

Plan 2

3.1% interest

Compounded Monthly for 17 years

How much money would she earn using this plan?

Identify all the variables. Round to the nearest cent.

Exit Slip:
Graph

$$y < 2(3)^{x-3} + 2$$

2) Given:

3.1% interest

Compounded Monthly for 17 years

How much money would earn using this plan? Identify all the variables. Round to the nearest cent.